REMARKS

Overview of the Office Action

Claims 1 and 3-5 have been rejected under 35 U.S.C. §102(b) as anticipated by "The Formation of Crystalline defects..." by Kawaguchi et al. ("Kawaguchi").

Claims 2 and 6-12 have been rejected under 35 U.S.C. §103(a) as unpatentable over Kawaguchi in view of Applicants' Admitted Prior Art ("AAPA").

Claims 13-17 and 34 have been rejected under 35 U.S.C. §103(a) as unpatentable over Kawaguchi in view of "InGaN-Based Blue Light Emitting Diodes..." by Mukai ("Mukai").

Status of the claims

Claim 1 has been amended.

Claims 18-33 have previously been canceled.

Claim 3 has now been canceled.

Claims 1-2, 4-17 and 34 remain pending.

Summary of subject matter disclosed in the specification

The following descriptive details are based on the specification. They are provided only for the convenience of the Examiner as part of the discussion presented herein, and are not intended to argue limitations which are unclaimed.

The disclosed method for fabricating a light-emitting device includes the step of forming at least one compound semiconductor layer based on gallium nitride and being an active layer or a part of an active layer sequence. The method further includes the step of setting growth parameters used during production of the compound semiconductor layer such that, at least in

some cases in a vicinity of dislocations in the compound semiconductor layer, regions are produced in the compound semiconductor layer having a lower thickness than remaining regions of the compound semiconductor layer. The regions with the lower thickness are formed to be less than half as thick as the remaining regions of the compound semiconductor laver.

Descriptive summary of Kawaguchi

Kawaguchi discusses the formation of crystalline defects and crystal growth mechanisms in $In_xGa_{1-x}N$ /GAN heterostructure grown by metalorganic vapor phase epitaxy. The composition pulling effect of $In_xGa_{1-x}N$ /GAN heterostructure is described in relation to lattice mismatch. Kawaguchi determines that the composition pulling effect at the initial growth stage occurred to reduce the lattice strain. As the layer thickness increased, the formation of defects decreased the lattice strain stored in the $In_xGa_{1-x}N$ /GAN layer owing to the lattice mismatch.

Claims 1 and 3-5 are allowable over Kawaguchi

The Office Action states that Kawaguchi teaches all of Applicants' recited elements.

Independent claim 1, as amended, recites a method for fabricating a light-emitting device that includes forming at least one compound semiconductor layer based on gallium nitride and being an active layer or a part of an active layer sequence. The method further includes setting growth parameters used during production of the compound semiconductor layer such that, at least in some cases in a vicinity of dislocations in the compound semiconductor layer, regions are produced in the compound semiconductor layer having a lower thickness than remaining regions of the compound semiconductor layer, *wherein the regions with the lower thickness are formed to be less than half as thick as the remaining regions of the compound semiconductor laver.*

Support for the italicized amendment to claim 1 can be found in Applicants' original claim 3.

Kawaguchi fails to teach or suggest the now-recited limitation "wherein said regions with the lower thickness are formed to be less than half as thick as the remaining regions of the compound semiconductor layer" of Applicants' amended independent claim 1.

The Examiner cites Fig. 4b of Kawaguchi as allegedly teaching that the regions are formed with lower thickness less than half as thick as the remaining regions of the compound semiconductor layer. Applicants submit that Kawaguchi has been misinterpreted.

Kawaguchi provides no statement or suggestion -- and neither is there any basis for concluding -- that Fig. 4b is drawn to scale and, therefore, there is no way to determine from Fig. 4b of Kawaguchi the relative thickness of the regions in the vicinity of dislocations.

To the contrary, Kawaguchi describes that the thickness of an analyzed $In_xGa_{1-x}N$ layer is 2μm (i.e., 2000nm thick) (see page 25, "Results and discussion" of Kawaguchi). Further, Kawaguchi discloses that "when the layer thickness was 2μm, the surface morphology becomes extremely rough and forms pyramid structure" and that "the height of the top of pyramid from the valley was about 300nm" (see page 25, "Results and discussion" of Kawaguchi).

In the context of Applicants' recited invention, the "valley" of Kawaguchi corresponds to a region of lower thickness (labeled "X" on the attached copy of Fig. 4b of Kawaguchi), the "top of the pyramid" of Kawaguchi corresponds to the remaining region (labeled "Y" on the attached copy of Fig. 4b), and the height to the top of pyramid from the valley (which according to Kawaguchi is about 300nm, is labeled Z on the attached copy of Fig. 4b).

Thus, the thickness of the $In_xGa_{1-x}N$ layer of Kawaguchi in the regions of lower thickness can in fact be calculated from its disclosure. Since the difference between the top of a pyramid and the valley of a pyramid is 300nm, the thickness of the $In_xGa_{1-x}N$ layer of Kawaguchi in the

regions of lower thickness is the difference between 2000nm and 300nm, i.e. 1700nm, which is significantly more than half as thick as the remaining regions of the semiconductor layer (i.e., 1700nm/2000nm = 0.85).

In contrast to Kawaguchi, Applicants' amended independent claim 1 expressly recites that "said regions with the lower thickness are formed to be less than half as thick as the remaining regions of the compound semiconductor laver". This is neither taught nor suggested by Kawaguchi.

In view of the foregoing, Applicants submit that Kawaguchi fails to teach or suggest the subject matter recited in Applicants' amended independent claim 1. Accordingly, claim 1 is deemed to be patentable over Kawaguchi under 35 U.S.C. §102(b).

Dependent claims

Claims 2, 4-17 and 34, which depend directly or indirectly from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over Kawaguchi for at least those reasons discussed above with respect to independent claim 1.

Claims 2 and 6-12 are allowable over Kawaguchi in view of the AAPA under 35 U.S.C. §103(a)

The Office Action further states that the combination of Kawaguchi and the AAPA teaches all of Applicants' recited elements.

Kawaguchi has been previously discussed and does not teach or suggest the invention recited in Applicants' independent claim 1.

Because Kawaguchi does not teach or suggest the subject matter recited in amended independent claim 1, and because the AAPA does not teach or suggest any elements of independent claim 1 that Kawaguchi is missing, the addition of the AAPA to the reference combination fails to adversely affect the non-obviousness of that claim.

Claims 2 and 6-12, which depend directly or indirectly from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over Kawaguchi and the AAPA for at least those reasons discussed above with respect to independent claim 1.

Claims 13-17 and 34 are allowable over Kawaguchi in view of Mukai under 35 U.S.C. §103(a)

The Office Action states that the combination of Kawaguchi and Mukai teaches all of Applicants' recited elements.

Kawaguchi has been previously discussed and does not teach or suggest the invention recited in Applicants' independent claim 1.

Because Kawaguchi does not teach or suggest the subject matter recited in amended independent claim 1, and because Mukai does not teach or suggest any elements of independent claim 1 that Kawaguchi is missing, the addition of Mukai to the reference combination fails to adversely affect the non-obviousness of that claim.

Claims 13-17 and 34, which depend directly or indirectly from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over Kawaguchi and Mukai for at least those reasons discussed above with respect to independent claim 1.

Conclusion

In view of the foregoing, reconsideration and withdrawal of all rejections, and allowance of all pending claims, are respectfully solicited.

Should the Examiner have any comments, questions, suggestions, or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

Respectfully submitted,

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Dated: August 20, 2007

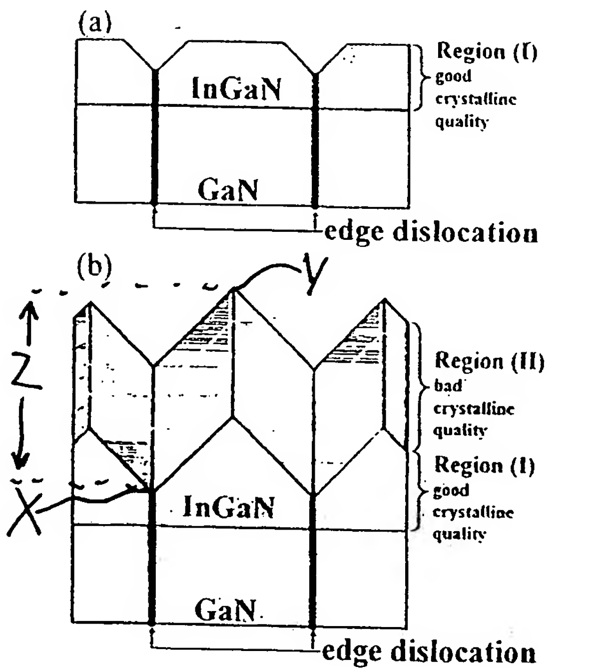

Fig. 4. Schematic diagrams of $In_xGa_{1-x}N$ on the GaN epitaxial layer for (a) thin $In_xGa_{1-x}N$ layer and (b) thick $In_xGa_{1-x}N$ layer.

4. Summary

The composition pulling effect of $In_xGa_{1-x}N$/GaN heterostructure has been studied in relation to the lattice mismatch. By TEM observations of the $In_xGa_{1-x}N$/GaN heterostructures, the edge dislocations penetrated to the GaN layer propagated into the $In_xGa_{1-x}N$ layer to form pits on the $In_xGa_{1-x}N$ surface. However, any other types of defects were not found near the interface of $In_xGa_{1-x}N$/GaN, indicating that coherent growth of $In_xGa_{1-x}N$ keeping high crystalline quality at the initial growth stage. By increasing the layer thickness, defects were generated and crystalline quality of $In_xGa_{1-x}N$ became worse. The $In_xGa_{1-x}N$ layer comprises the good crystalline quality layer and the bad crystalline quality layer, and EDX composition analysis showed that the composition of $In_xGa_{1-x}N$ near the interface was close to that of GaN. In conclusion, the composition pulling effect at the initial growth stage occurred to reduce the lattice strain. As the layer got thicker, the formation of defects decreased the lattice strain stored in the $In_xGa_{1-x}N$ layer owing to the lattice mismatch.

References

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